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GLACIAL GEOLOGY OF THE VANDALIA, ILLINOIS, REGION

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ABSTRACT

Deposits and soils of the Kansan, Yarmouthian, Illinoian, Sangamonian, and Wisconsinan Stages are present in the region surrounding Vandalia (south-central), Illinois. Kansan till exposures, with a truncated Yarmouth Soil, are exposed at a few places. The unaltered till is sandy and silty, and its less than 2-micron size fraction contains abundant illite and more calcite than dolomite. The Smithboro till (lowermost Illinoian) is relatively silty, plastic, and its less than 2-micron size fraction contains more dolomite than calcite and more expandable clay minerals than any till in this region. The overlying Vandalia till (Illinoian) is relatively sandy, friable, and its less than 2-micron size fraction contains abundant illite and more dolomite than calcite.

The Mulberry Grove silt lies between the Vandalia and Smithboro tills at some localities. The Hagarstown beds (Illinoian) overlie the Vandalia till and consist of sand, gravel, poorly sorted gravel, and gravelly till. The gravel forms the core of elongate linear or curving ridges on upland drift plains. These ridge gravels were deposited by meltwater streams in ice-walled channels during stagnation of the glacier that deposited the Vandalia till. Other lithologies of the Hagarstown beds were deposited as outwash, ablation deposits, or mass-movement material on the ice between the ice-walled channels. The Sangamon Soil was formed on the Hagarstown beds or, where the Hagarstown beds are absent, on the Vandalia till.

Illinoian deposits, or the Sangamon Soil, are overlain by accretion-gleys, lacustrine and wetland sediments

(Sangamonian and Wisconsinan), and Roxana Silt and Peoria Loess (Wisconsinan). Wisconsinan outwash occupies major stream valleys.

INTRODUCTION

The glacial deposits of the Vandalia region are of special interest because of the abundant and extensive sand and gravel deposits that have long been an important source of building and road materials. Sand and gravel deposits are relatively small and widely scattered elsewhere in south-central Illinois.

The Vandalia region is underlain by as much as 200 feet (60 m) of Pleistocene sediments that were largely derived from repeated advances of continental glaciers. These sediments include till sheets of Kansan and Illinoian age, Illinoian and younger water-laid deposits, and Wisconsinan loess, silts, and valley train deposits. The Pleistocene sediments overlie Pennsylvanian bedrock of the Bond and Mattoon Formations. They are locally absent in a few places along the valleys where the Pennsylvanian rocks crop out.

The Vandalia region of this report includes those parts of Fayette, Shelby, Montgomery, Marion, and Bond Counties included on the Greenville, Hillsboro, Ramsey, and Vandalia 15-minute topographic quadrangle maps (figs. 1 and 2).

Most of south-central Illinois is a relatively flat and featureless drift plain underlain by Illinoian glacial deposits. The Vandalia region, however, includes part of a system of elongate ridges and knolls, largely sand and gravel, that extends from a point where overlain by the terminal Wisconsinan (Shelbyville) moraine in Shelby and Macon Counties, southwest to Belleville, Illinois, and then, in a somewhat subdued fashion, south and southeast into Monroe and Randolph Counties (fig. 1). These ridges are of Illinoian age and have been called the ridged drift of the Kaskaskia Basin (Leverett, 1899).

Some ridges are continuous for several miles, and a few may be traced with only minor gaps for tens of miles. They are usually 50 to 100 feet (15 to 30 m) high. The axes of the ridges are straight or gently curving, and frequently intersect other ridges or ridge trends. The dominant trend is NNE-SSW, but some trend NNW-SSE. Knolls are usually less than 50 feet high (with notable exceptions). They are either isolated on the drift plains, in clusters, or aligned with ridge trends.

Ridges of sand and gravel are locally present on the Illinoian drift plain outside the ridged drift. These ridges are generally smaller and less numerous but similar to those of the ridged drift belt in other respects.

The Ridged Drift Problem

Since Leverett's pioneer work in 1899, the composition and origin of the ridged drift have been controversial (table 1). Many have interpreted the ridges as composed largely of sand and gravel with minor amounts of till. Broadhead (1875) described extensive beds of sand and gravel in the ridges near Vandalia that were used as railroad ballast and roadfill. Shaw (1923) and MacClintock (1929) mentioned the abundance of sand and gravel in some of the ridges. Ball (1940) compiled information on 15 ridges and indicated that those ridges contained a predominance of sand and gravel. Jacobs and Lineback (1968) reported that the

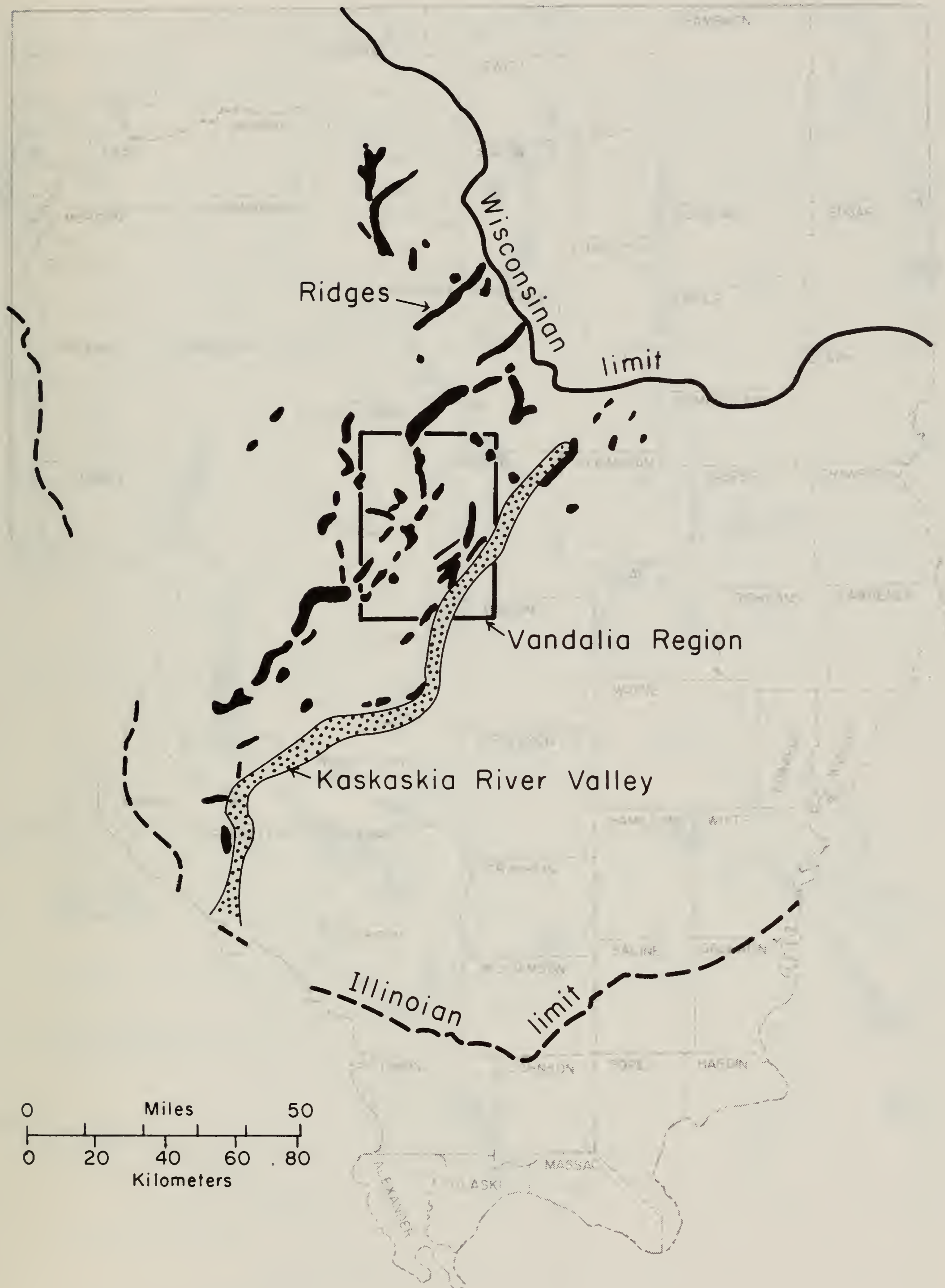

Fig. 1 - Vandalia region in relation to major glacial features.

Fig. 2 - Surficial geology of the Vandalia region.

elongate ridges contain mostly sand and gravel, and the isolated knolls contain gravel, till, and ice-thrusted bedrock blocks.

Leverett (1899) favored a marginal moraine of a lobe from the east because this hypothesis was "apparently supported by the distribution of the ridges" whose "southward extension encircles the supposed lobe." Topographic maps published after Leverett's report do not show the looplike distribution he described. Connecting the ridged drift belt eastward from the mouth of the Kaskaskia River, moreover, is highly speculative because of the presence of bedrock-cored ridges and erosional divides.

Shaw (1923) emphasized differences between the ridged drift and typical moraines. MacClintock (1929) supported Leverett's favored hypothesis because of "considerable outwash material on the west side of many of the ridges, and... well developed outwash-plains extending westward from masses of drift." The distribution of outwash, however, on the west, east, and within the ridges does not support a typical moraine and outwash fan relationship.

Ball (1940) favored a glaciofluvial origin (crevasse fillings, eskers, and kames) because (1) outcrops and well records indicated that certain ridges have a gravel core of considerable linear extent, and (2) the ridges are elongate and straight, subparallel in alignment, uniform in summit elevations, and located on uplands. Ekblaw (Flint and others, 1959) connected the Jacksonville moraine with the ridged drift belt, also in support of Leverett's marginal moraine hypothesis. Leighton (1959) and Leighton and Brophy (1961) concurred with Ball's glaciofluvi-

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EXPLANATION FOR FIGURE 2

QUATERNARY SYSTEM

Qoa	Wisconsinan outwash and Recent alluvium
Ql	Wisconsinan and older (?) organic-rich lake silts
Qir	Illinoian Hagarstown beds in ridges and kames, largely gravel and sand
Qid	Illinoian drift plain: thin Hagarstown beds; local areas underlain by Vandalia till, Mulberry Grove silt, and Smithboro till
Qkt	Kansan till

PENNSYLVANIAN SYSTEM

Pbm	Bond and Mattoon Formations undifferentiated

Gravel pits (1968): Active ✕

Inactive

Sections described in text: △

TABLE 1 - SUMMARY OF THE EXPLANATIONS FOR THE ORIGIN OF THE RIDGED DRIFT

Investigators	Origin
Broadhead (1875, p. 131)	Pleistocene sea
Leverett (1899, p. 73-74)	Proposed five hypotheses: 1. Origin similar to drumlins 2. Interlobate moraine 3. Marginal moraine of a lobe from the the east (favored by Leverett) 4. Due to bedrock nuclei 5. Erosional remnant of a drift sheet
Shaw (1923, p. 5)	Some are like kames and eskers; most are not similar to typical moraines
MacClintock (1929, p. 23-24)	Marginal moraine with kame-and-kettle features; favored Leverett's third hypothesis
Ball (1940, p. 969-970)	Glaciofluvial (eskers or crevasse fillings)
Ekblaw (Flint and others, 1959)	Marginal moraine of a lobe from the east
Leighton (1959, p. 338-340) and Leighton and Brophy (1961, p. 10-13)	Crevasse deposits and moulin kames
Willman, Glass, and Frye (1963, p. 5)	Interlobate complex

al origin. They called the elongate ridges crevasse deposits because of "parallel alignment" and "right angle intersection," whereas the term moulin kame was applied to isolated knolls. Willman, Glass, and Frye (1963) suggested that the ridges represent an interlobate complex because of "pronounced differences in mineralogy of the till on the two sides of the ridged drift."

Individual ridge intersections are nearly at 60° angles and form a dendritic pattern along the course of ridge trends. This supports a glaciofluvial origin in a superglacial or englacial drainage system. Some of the ridges are straight and the meltwater channels in which they were deposited probably were controlled by crevasses. Other ridges, however, are broad and gently curving, suggesting that channels were widened and curved by meltwater erosion. The preservation of extensive elongate ridges with intact cross-bedding indicates widespread stagnation of the glacier. Kames containing ice-thrusted bedrock blocks suggest local movement of active ice over stagnant ice. Because the elongate ridges are parallel to the buried Kaskaskia bedrock valley and the dip of cross-beds of outwash in the ridges has a vector mean toward the southwest, the drainage system of the stagnating Illinoian glacier was probably toward the southwest, down the slope of the Kaskaskia Basin.

Topography

The Kaskaskia River and its tributaries occupy valleys entrenched into the glacial sediments. Locally, the valleys have penetrated bedrock. The inter-stream areas have undergone little erosion. The permeable nature of the gravelly sediments on the upland surfaces has allowed much of the available moisture to infiltrate rather than to wash over upland slopes, so that sheetwash, mass wasting, and headward erosion of streams have been retarded. The reduced erosion of up-land areas has resulted in the preservation of depositional features such as steep-sided elongate ridges, knolls, and lake basins.

Acknowledgments

The clay mineral and carbonate analyses in this report were made by X-ray diffraction analysis of oriented slides of the less than 2-micron fraction by H. D. Glass, and the grain size analyses were made by hydrometer and sieving under the supervision of W. A. White, both of the Illinois State Geological Survey.

STRATIGRAPHY

The sequence and major characteristics of the Pleistocene deposits in the Vandalia region are summarized in table 2. The surface distribution of the deposits is shown in figure 2, and the general relations of the deposits are shown diagrammatically in figure 3.

Kansan Stage

Kansan till is exposed in only a few places along the banks of the Kaskaskia River (Vandalia Bridge Section, following manuscript, and fig. 4) and along Ramsey Creek (fig. 2). It is recognized in the field by a zone of leaching below calcareous Illinoian till. The Kansan till is dark gray, compact, and slightly sandy. It averages 33 percent sand (standard deviation, or s=3), 42 percent silt (s=5), and 25 percent clay (s=3) for 21 analyses of 7 samples from 1 locality. The percentage of sand is intermediate between the two overlying Illinoian tills. Unweathered Kansan till is also distinguished by usually having two times as much calcite as dolomite and by a lower percentage of expandable clay minerals than the basal (Smithboro) Illinoian till. ("Expandable clay minerals" in this report include montmorillonite and mixed-layer clay minerals.)

Preliminary fabric studies of Kansan till indicate that the Kansan ice sheet advanced from the north or northeast. The Kansan till in the Vandalia region is in the area of the eastern Kansan of Willman, Glass, and Frye (1963).

Yarmouthian Stage

A truncated Yarmouth Soil is exposed at the Vandalia Bridge Section (fig. 4). Leaching in the profile extends 2 feet (60 cm) into the Kansan till. Expandable clay minerals progressively increase upward in the profile, but a B-zone is not present

TABLE 2 - COMPARISON OF THE GRAIN SIZE, CLAY MINERALOGY, AND CARBONATE MINERALOGY OF QUATERNARY DEPOSITS IN THE VANDALIA REGION

Stage	Deposits	Grain size	Clay mineralogy (< 2μ)	Carbonate mineralogy (< 2μ)
RECENT	Alluvium	Generally fine grained	No data	Leached
	Accretion-gleys	Clay rich	Rich in expandable clay minerals	Leached
	Lacustrine	Silt and clay	Rich in expandable clay minerals	Leached
WISCONSINAN	Peoria Loess	Silt	Variable, but generally rich in expandable clay minerals	Mostly thin and leached
	Roxana Silt	Sandy	Rich in expandable clay minerals	Leached
	Accretion-gleys	Clay rich	Rich in expandable clay minerals	Leached
	Lacustrine	Silt, clay, gyttja (organic-rich mud)	Variable	Partly calcareous
	Valley train	Fine- to coarse-grained outwash	No data	No data
SANGAMONIAN	Lacustrine (?)	Silt, clay, gyttja (?)	Rich in illite	Calcareous
	Accretion-gleys	Clay rich	Rich in expandable clay minerals	Leached
ILLINOIAN	Hagarstown beds	Well sorted gravel, sand, poorly sorted gravel, gravelly till	Rich in illite where unweathered	Dolomite usually more than calcite; mostly leached where thin
	Vandalia till (some sand and gravel)	Sandy (43 ± 10%* sand, 38 ± 10% silt, 19 ± 5% clay)	Rich in illite, poor in expandable clay minerals	Dolomite usually more than calcite
	Mulberry Grove silt (some sand and gravel)	Variable	No data	No data
	Smithboro till (little sand and gravel)	Silty (25 ± 7% sand, 49 ± 7% silt, 26 ± 7% clay)	More expandable clay minerals than other tills	More dolomite than calcite, but lower in total carbonate than other tills
YARMOUTHIAN	Buried soil (no deposits)			
KANSAN	Till	Somewhat sandy (33 ± 6% sand, 42 ± 10% silt, 25 ± 5% clay)	Rich in illite, poor in expandable clay minerals	Calcite about twice dolomite

*Mean percent ± 2 standard deviations

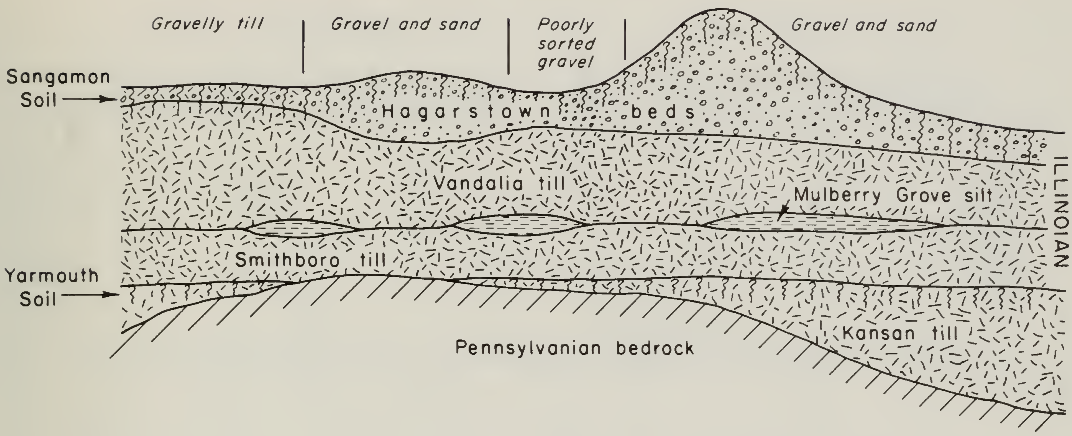

Fig. 3 - Diagrammatic cross section of the glacial stratigraphy of the Vandalia region. Wisconsinan deposits not shown.

Illinoian Stage

Illinoian deposits in the Vandalia region in ascending stratigraphic position include the Smithboro till, the Mulberry Grove silt, and the Vandalia till. The Vandalia till is overlain in part of the area by water-laid deposits and some gravelly till, collectively called the Hagarstown beds. These are informal rock-stratigraphic units named in this report. The Smithboro and Vandalia tills are present over most of the Hillsboro and Ramsey Quadrangles, but one or the other is locally missing in parts of the Vandalia and Greenville Quadrangles.

Smithboro till

The Smithboro till is a gray, compact till that is softer, more silty, and less friable than the overlying Vandalia till. It is herein named informally for the village of Smithboro, 5 miles (8 km) west of the Mulberry Grove Section (fig. 5), which is the type section. It is also well exposed in the Vandalia Bridge Section (fig. 4).

The Smithboro till contains an average of 25 percent sand (s=4), 49 percent silt (s=4), and 26 percent clay (s=4) from 71 analyses of 23 samples from 15 localities. Most samples contain a slightly higher content of dolomite than calcite, but the total content of carbonate in the less than 2-micron fraction is less than that of the other tills in the region. The unweathered Smithboro till contains more expandable clay minerals than unweathered Kansan till or the Vandalia till.

Preliminary fabric studies of the Smithboro till indicate that it was deposited by an ice sheet that moved to the southeast across the Vandalia region. The Smithboro till probably correlates with the Mendon till, defined as the lowest Illinoian till in western Illinois by Frye, Willman, and Glass, (1964), which previously was called Payson (Willman, Glass, and Frye, 1963). In the latter report, the Illinoian of the Vandalia region was included in the Payson.

The Smithboro till is probably equivalent to the till called Jacksonville-Mendon in the area immediately northwest of the Vandalia region (Johnson, 1964). It is also equivalent to some till exposures called Kansan in the Carlinville area (Ball, 1952), which lack a soil at the top and are earliest Illinoian in age.

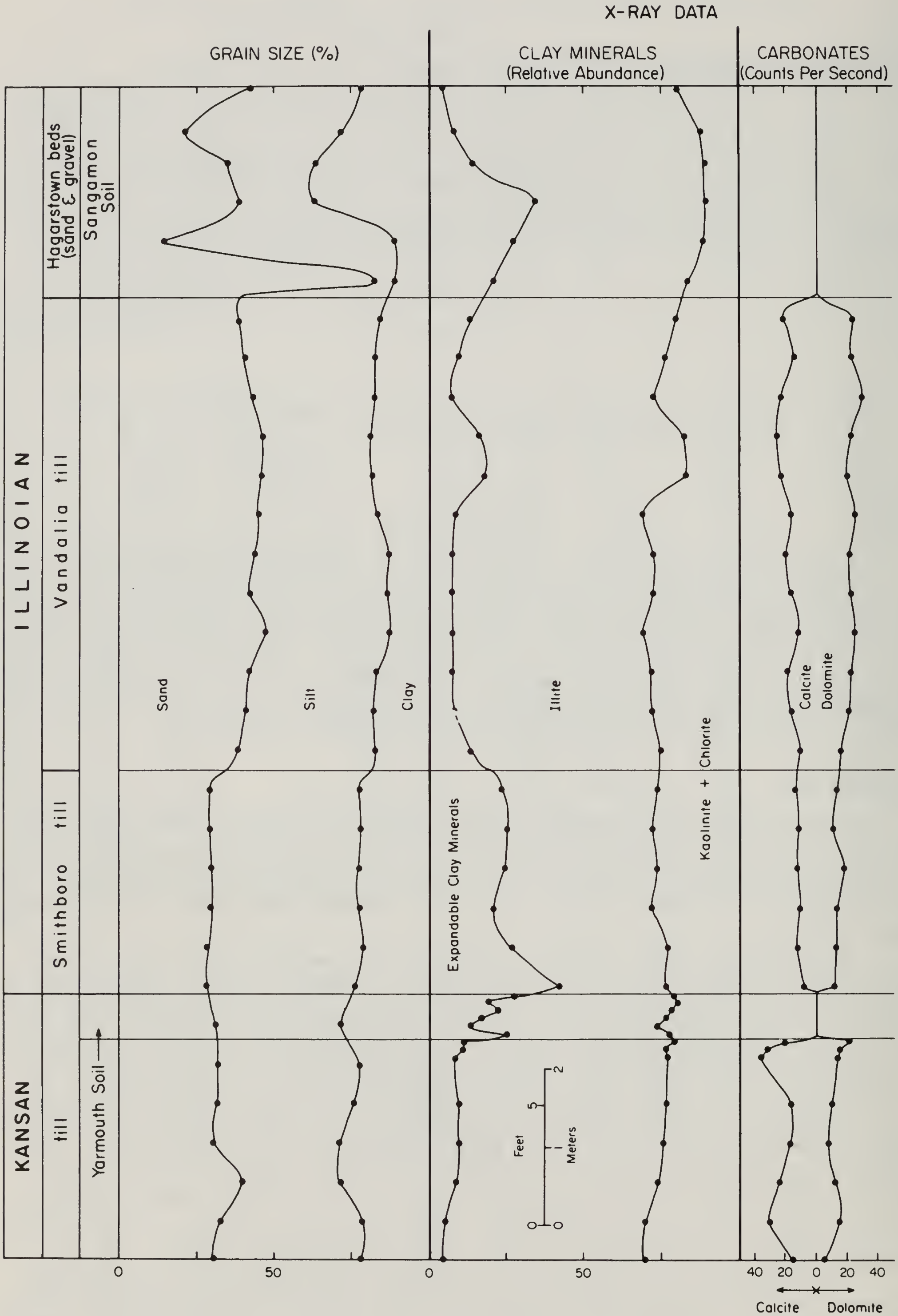

Fig. 4 - Grain size and X-ray mineralogy data of the Vandalia Bridge Section.

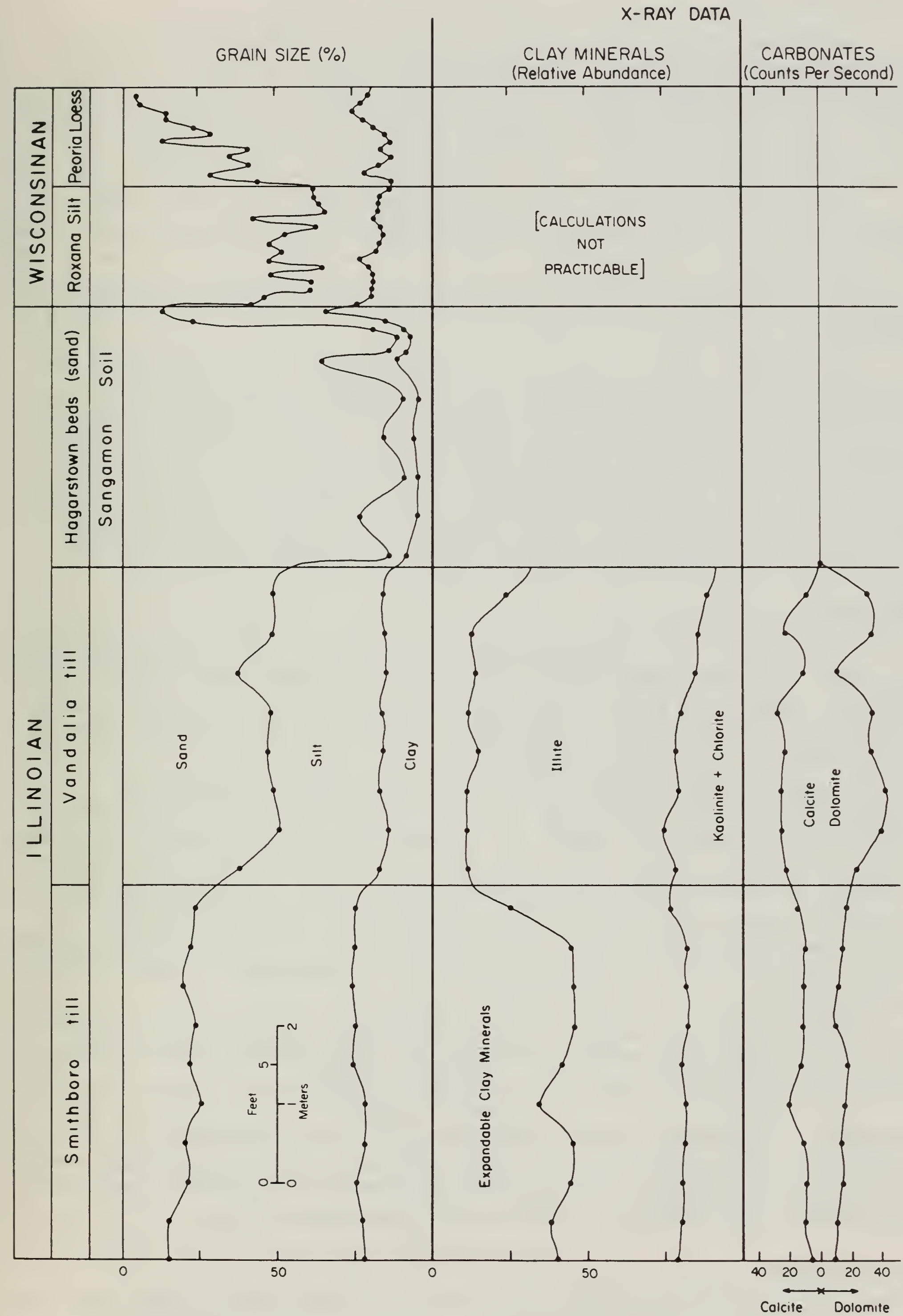

Fig. 5 - Grain size and X-ray mineralogy data of the Mulberry Grove Section.

Mulberry Grove silt

The Mulberry Grove silt separates the Smithboro till from the overlying Vandalia till at some localities. It is calcareous, up to 1.5 feet (0.5 m) thick, and consists mostly of silt with occasional lenses of sand and gravel. It is herein named informally for the town of Mulberry Grove, just west of the type section (Mulberry Grove Section and fig. 5). In the eastern part of the Mulberry Grove Section, the Vandalia till cuts out the silt and directly overlies the Smithboro till.

The Mulberry Grove silt occasionally contains abundant plant fragments. An organic-rich bed of silt caps the Mulberry Grove silt at the type section. Spruce pollen (cold climate) is found in some samples from nearby areas. At a few localities the upper part of the Smithboro till is oxidized below the base of unoxidized Vandalia till. No evidence of leaching has been found between the Smithboro and Vandalia tills.

MacClintock (1929) and Ball (1952) interpreted the silt bed between the two Illinoian tills in certain localities to be a Yarmouthian deposit and the lower till to be Kansan. The Mulberry Grove silt is everywhere calcareous, contains cold (periglacial) climate pollen, lacks evidence of soil development, and in a few places lies stratigraphically higher than the Yarmouth Soil. The silt bed, therefore, may mark a period of time between the wastage of the Illinoian glacier that deposited the Smithboro till and the advance of the glacier that deposited the Vandalia till, but absence of leaching indicates that the interval was short.

Vandalia till

The Vandalia till is a relatively sandy, compact till that overlies the Mulberry Grove silt (or the Smithboro till where the silt is absent) and is well exposed in the area. It is herein named informally for the town of Vandalia, and the type section is just north of the U. S. Highway 51 bridge over the Kaskaskia River at Vandalia (Vandalia Bridge Section and fig. 4).

The Vandalia till is gray in color where unoxidized, but it is usually deeply oxidized due to weathering during the Sangamonian Stage. The till contains numerous thin lenticular beds of silt, sand, and gravel, and it contains many more pebbles and cobbles per unit volume than does the Smithboro till. The Vandalia till averages 43 percent sand ($s=5$), 38 percent silt ($s=5$), and 19 percent clay ($s=3$) for 207 analyses of 60 samples from 23 localities. It contains a low percentage of expandable clay minerals and two-thirds of the samples contain slightly more dolomite than calcite. Only a few samples have as great an excess of calcite over dolomite as any sample of Kansan till.

Preliminary fabric analyses of the Vandalia till indicate that the ice advanced from the northeast, and the dominance of illite is in agreement with a Michigan Lobe source (Willman, Frye, and Glass, 1963).

The Vandalia till is at the stratigraphic position of the middle Illinoian Jacksonville till of Willman, Frye, and Glass (1963) and is equivalent to it. The middle Illinoian, therefore, has a much wider extent than previously mapped. The till called Jacksonville by Johnson (1964) in the area immediately northwest of the Vandalia region probably correlates with the Vandalia till.

Hagarstown beds

The Hagarstown beds comprise four types of sediments—gravelly till, poorly sorted gravel, well sorted gravel, and sand (table 3)—that lie stratigraph-

TABLE 3 - TYPES OF DEPOSITS IN THE HAGARSTOWN BEDS

Types	Topographic expression	Section where well displayed
Gravelly till	Drift plains	Liberty Creek
Poorly sorted gravel	Drift plains near ridges	Ramsey Creek
Well sorted gravel	Elongate ridges	Hickory Ridge
Sand	Drift plain near Mulberry Grove	Mulberry Grove

ically above the Vandalia till and contain the Sangamon Soil at the top. The unit is herein named informally for the town of Hagarstown, 5 miles (8 km) west of the type section (Hickory Ridge Section).

Elongate ridges of the Hagarstown beds consist of predominantly well sorted gravel and interbedded sand. More than 20 gravel pits, including 8 still active, have been opened in the drift ridges of the Vandalia area. Ridge gravels are often cross-bedded and cemented with calcite. Cross-bedding is fluvial, and foreset slopes are directed southward, generally parallel to the ridge trend. A gravel deposit in a ridge trending northeastward from Greenville alternately lies on the surface of the Vandalia till and in a deep erosional channel within the till.

In drift plains between or near the ridges, the Hagarstown beds consist of (1) gravelly till more distant from the ridges, which grades into (2) poorly sorted gravel near the ridges, (3) sand locally present near Mulberry Grove, and (4) well sorted gravel along the linear trend of gravel ridges.

Kames occur isolated or along the trends of elongate ridges. Their composition is variable because of ice-thrusting and collapse phenomena. They contain well sorted and poorly sorted gravel, blocks of Vandalia till, Smithboro till, and bedrock in complex structural relationships.

The different types of Hagarstown beds grade into one another, varying with the degree of water-sorting. They are much less compact and much more permeable than the underlying Vandalia till. They contain few, if any, striated pebbles, and the pebbles in the gravelly till have their long axes less well aligned than those in the underlying Vandalia or Smithboro tills.

Sediments similar to the Hagarstown beds are present in association with subdued ridges of sand and gravel in areas outside the ridged drift belt. Ekblaw (1929) described a landslide near the eastern border of Fayette County (SW$\frac{1}{2}$ NE$\frac{1}{2}$ Sec. 12, T. 5 N., R. 4 E.) involving the collapse of "an intimate assortment of fine gravel, sand, silt, and till clay." Near Effingham, 40 miles (64 km) east of Vandalia, Ekblaw (1957) also described as outwash an irregular layer of sand and gravel of Illinoian age, extending to depths of 15 and 17 feet below the upland surface.

The Hagarstown beds are derived from till that was thrust to the surface of the glacier, subjected to washing and mass movement, and deposited when the ice melted out beneath it. Well preserved bedding of glaciofluvial sediment indicates large-scale ice stagnation. The variability and relatively poor compaction of the Hagarstown beds favor an ablation origin.

An ice-walled drainage system developed on, or partly in, the stagnant ice that deposited the Vandalia till. Some superglacial debris was washed into ice-

walled channels and was sorted by fluvial action. Superglacial material that was not swept into ice-walled channels was not sorted, and, when the ice melted, it was deposited on the till surface between the ridges of sand and gravel. A crude sorting resulting from mass movement could have developed the Hagarstown beds that are texturally gradational between till and outwash.

The Hagarstown beds are associated with the Vandalia till and are considered middle Illinoian in age.

Sangamonian Stage

Sangamon Soil

The Sangamon Soil is commonly developed on the Hagarstown beds in the Vandalia area. The variation in grain size and relative permeability of the Hagarstown beds result in varying characteristics of the Sangamon Soil (table 4). Where the Hagarstown beds are thin, the Sangamon Soil extends through them into the underlying compact till. At many exposures other than those in ridges, the Hagarstown beds are leached to the contact with the underlying Vandalia till or into the till only a few inches (Vandalia Bridge Section and fig. 4; Mulberry Grove Section and fig. 5). This results from the relatively greater permeability of the Hagarstown beds. At a few localities, the lower few inches of the Hagarstown beds are calcareous (Liberty Creek and Linn Creek Sections and fig. 6), and, at others, leaching has extended a considerable distance into the Vandalia till (Ramsey Creek Section and fig. 7). Where the Hagarstown beds are absent, the Sangamon Soil is developed directly on the Vandalia till (Jewett Section and fig. 8).

TABLE 4 - COMPARISON OF THE LEACHED ZONE OF IN SITU SANGAMON SOIL ON VANDALIA TILL AND ON THE HAGARSTOWN BEDS

		Hagarstown beds		
	Vandalia till	Gravel	Sand	Poorly sorted gravel and gravelly till
Depth of leaching	Shallow, less than 6 feet (2 m)	Deep, up to 15 feet (5 m)	Deep, but B-zone less than 1 foot (30 cm)	Deeper than profiles on Vandalia till
Color	Reddish brown to yellow-brown	Red	Yellow-brown and mottled	Brownish red
Pebble content	Decreases from CC- into CL-zone	High	Negligible	Higher than Vandalia till
Sand content	Increases slightly from CC- into CL-zone	High	More than 75% sand	Higher than Vandalia till
Compact structure	Compact even in CL-zone	Noncompact	Noncompact	Noncompact

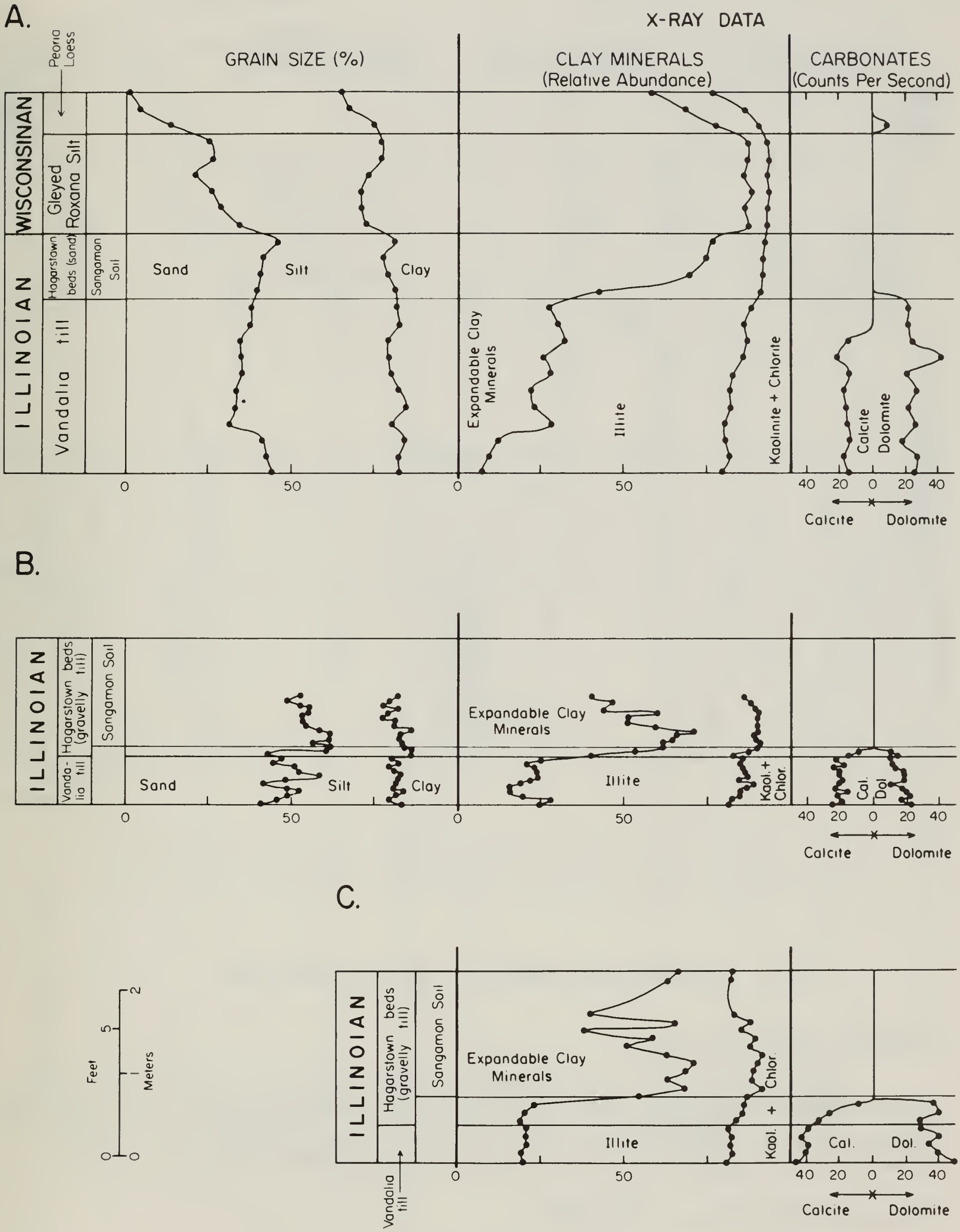

Fig. 6 - Grain size and X-ray mineralogy data of the (A) Ramsey West, (B) Liberty Creek, and (C) Linn Creek Sections.

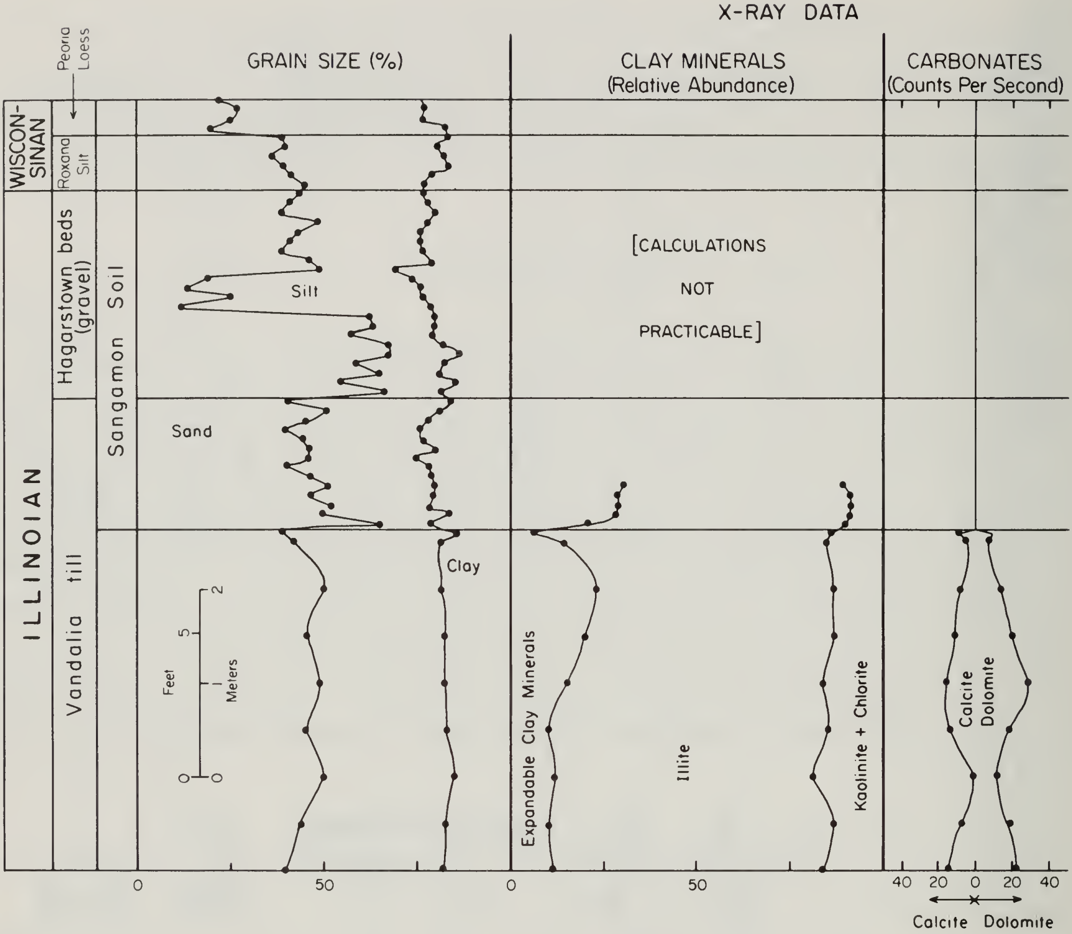

Fig. 7 - Grain size and X-ray mineralogy data of the Ramsey Creek Section.

Sangamonian Stage (?) - Wisconsinan Stage

Accretion-gleys and silts

Gray gleyed clays and silts blanket large expanses of upland drift plains in the Vandalia region and nearby areas in south-central Illinois. These deposits include Sangamonian accretion-gleys and Wisconsinan silts and loess deposited in wetland environments on flat upland areas (Ramsey West Section and fig. 6).

Lacustrine silts, clays, and gyttja

Lacustrine silts, clays, and gyttja (organic-rich lake mud) occur in local undrained depressions in a 100-square mile area southwest of Vandalia. These sediments contain pollen, seeds, ostracode carapaces, diatom frustules, pelecy-

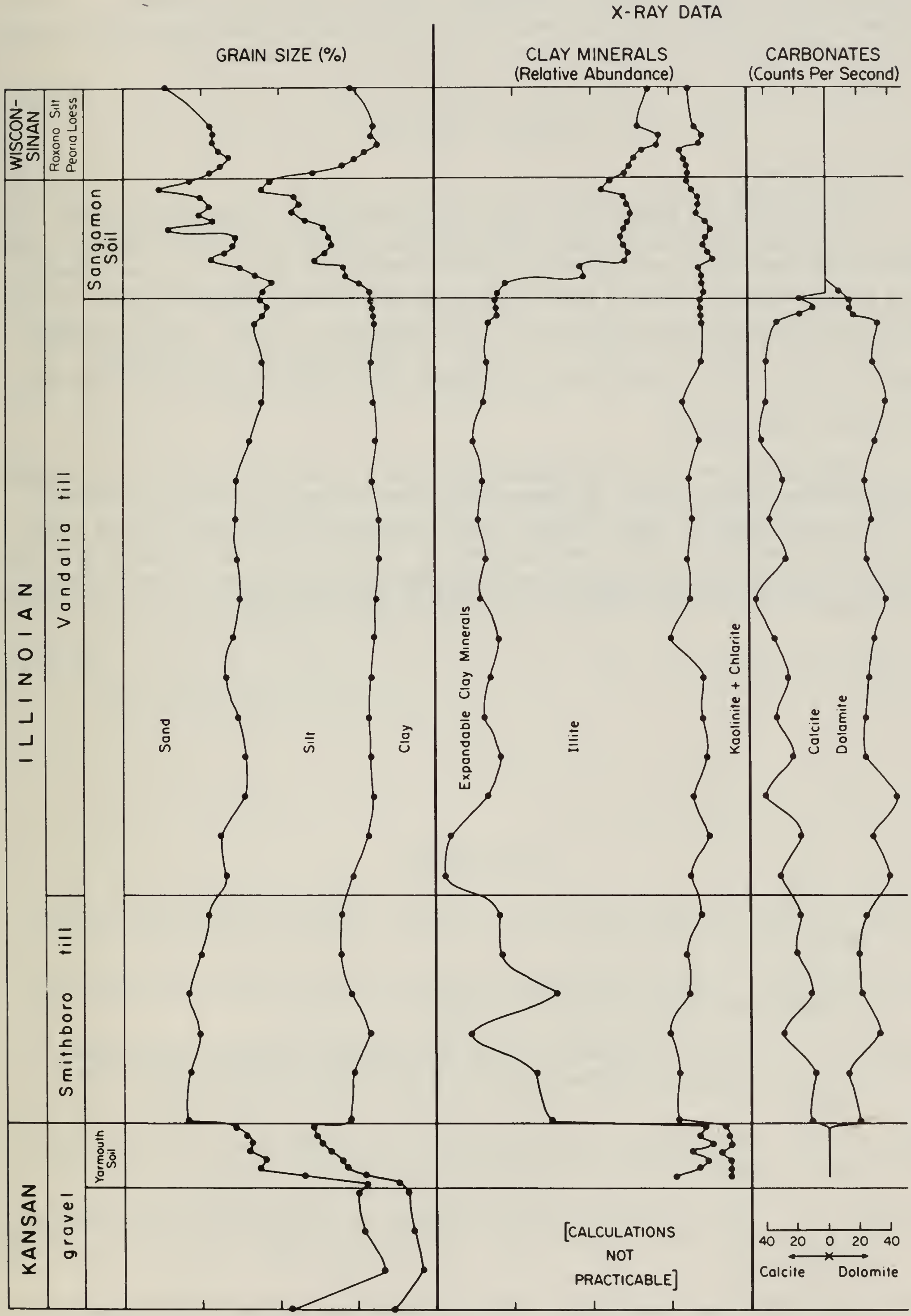

Fig. 8 - Grain size and X-ray mineralogy data of the Jewett Section.

pod shells, and gastropod shells, indicating an open-water environment. Cores of these lacustrine sediments are being studied in collaboration with the Limnological Research Center of the University of Minnesota (Minneapolis).

Wisconsinan Stage

Wisconsinan loess

Roxana Silt and Peoria Loess are widely present in the Vandalia area. In well drained areas the Roxana Silt commonly consists of 1.5 feet (0.5 m) of reddish brown to pinkish brown silt (Mulberry Grove Section and fig. 5). The overlying Peoria Loess averages about 3 feet (1 m) in the area and is brown or yellow-brown. Roxana Silt contains more sand than the Peoria Loess. Locally, the Roxana Silt and Peoria Loess were deposited in wetland environments on the uplands of the Vandalia region. Where deposited in wetlands, the loess is gray and thixotropic.

Wisconsinan valley train

Much of the valley of the Kaskaskia River is filled with valley train deposits derived from outwash from the Shelbyville (Woodfordian) ice front at Shelbyville, Illinois, about 35 miles (56 km) north-northeast of Vandalia. Local tributaries of the Kaskaskia in the Vandalia area do not have their headwaters near the margin of Wisconsinan glaciation, but they contain slack-water deposits that accumulated when the main channel was choked with outwash.

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SELECTED GEOLOGIC SECTIONS

The following are geologic sections from selected outcrop exposures among those studied and sampled for this report. The sample numbers in the P- series are the numbers used in the Illinois State Geological Survey Pleistocene collections. Sample intervals vary between 5 cm and 50 cm. Analytical data from individual samples are available at the Geological Survey and were used in constructing the compositional graphs (figs. 4 to 8) included in this report. The sections are arranged alphabetically by name.

Hickory Ridge Section

Gravel pit in the SW¼ NW¼ Sec. 30, T. 6 N., R. 1 E., Fayette County, Illinois, Vandalia 15-minute Quadrangle.

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Wisconsinan Stage		
Roxana Silt and Peoria Loess		
3. Silt and loess	2.6	0.8
Illinoian Stage		
Hagarstown beds		
2. Gravel, silty and clayey, brownish red, poorly bedded and cross-bedded, noncalcareous; B-zone of Sangamon Soil in upper 6.6 feet (2.0 m)	9.8	3.0
1. Gravel and sand, well sorted, very light brown, cross-bedded, largely uncemented, calcareous; intermixed in thick lenses	20.0	6.0
Base covered.		
Totals	32.4	9.8

Jewett Section

Roadcut in the SE cor. NE¼ NE¼ Sec. 36, T. 9 N., R. 8 E., Cumberland County, Illinois, Greenup 15-minute Quadrangle (fig. 8).

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Wisconsinan Stage		
Roxana Silt and Peoria Loess		
6. Silt and loess (P-3472 to P-3479 upward)	3.6	1.1
Illinoian Stage		
Vandalia till		
5. Till, compact, sandy, pale yellow-brown, jointed and friable, noncalcareous; B-zone of Sangamon Soil in upper 1.5 feet (0.5 m) (P-3457 to P-3471)	4.9	1.5
4. Till, compact, sandy, pale yellow-brown, jointed and friable, calcareous (P-3439 to P-3456)	22.0	6.7
Smithboro till		
3. Till, compact, silty, gray to blue-gray, plastic, calcareous (P-3433 to P-3438)	12.1	3.7
Kansan Stage		
2. Till, yellow-brown, leached; CL-zone of Yarmouth Soil (P-3425 to P-3432)	1.5	0.5
1. Till, reddish brown, calcareous, sandy, compact; gravel, calcareous, lenticular (P-3421 to P-3424; P-4075, P-4076)	7.7	2.3
Base covered.		
Totals	51.8	15.8

Liberty Creek Section

Roadcut in the NW cor. NE¼ NE¼ Sec. 21, T. 8 N., R. 1 W., Fayette County, Illinois, Ramsey 15-minute Quadrangle (fig. 6).

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Illinoian Stage		
Hagarstown beds		
3. Gravelly till, poorly compacted, brownish red, noncalcareous; CL- and B-zones of Sangamon Soil (P-3225 to P-3237 upward in lower part)	4.3	1.3
2. Gravelly till, poorly compacted, gravelly, sandy, brownish gray, calcareous (P-3223, P-3224)	0.3	0.1
Vandalia till		
1. Till, compact, sandy, pale yellow-brown, jointed and friable, calcareous (P-3211 to P-3222)	3.9	1.2
Base covered.		
Totals	8.5	2.6

Linn Creek Section

Roadcut in the SE¼ NW¼ Sec. 17, T. 7 N., R. 2 E., Fayette County, Illinois, Ramsey 15-minute Quadrangle (fig. 6).

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Wisconsinan Stage		
Roxana Silt and Peoria Loess		
4. Silt and loess (P-3386)	0.3+	0.1+
Illinoian Stage		
Hagarstown beds		
3. Gravelly till, poorly compacted, noncalcareous; CL- and B-zone of Sangamon Soil (P-3369 to P-3385 upward)	5.6	1.7
2. Gravelly till, poorly compacted, calcareous (P-3366 to P-3368)	1.0	0.3
Vandalia till		
1. Till, sandy, pale yellow-brown, jointed and friable, calcareous (P-3361 to P-3365)	6.6	2.0
Base covered.		
Totals	13.5	4.1

Mulberry Grove Section

Borrow pits along Interstate Highway 70, SW¼ Sec. 31, T. 6 N., R. 1 W., Fayette County, Illinois, Greenville 15-minute Quadrangle (fig. 5).

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Wisconsinan Stage		
Woodfordian Substage		
Peoria Loess		
6. Loess, light brown, noncalcareous; surface soil in upper part (P-3848 to P-3859 upward)	3.9	1.2
Altonian Substage		
Roxana Silt		
5. Silt, reddish brown, noncalcareous; bottom 3.0 feet (0.9 m) is mottled (P-3830 to P-3847)	5.9	1.8

	Thickness (feet)	Thickness (meters)
Illinoian Stage		
Hagarstown beds		
4. Sand, well washed but with some clay, brownish yellow, leached; B-zone of Sangamon Soil developed on upper 1.5 feet (0.5 m) (P-3820 to P-3829)	16.4	5.0
Vandalia till		
3. Till, compact, sandy, pebbly, pale yellow-brown, jointed and friable, calcareous (P-3809 to P-3816; P-3819)	13.1	4.0
Mulberry Grove silt		
2. Silt, laminated, gray to dark gray where carbonaceous, lenticular, calcareous	0 - 3.3	0 - 1
Smithboro till		
1. Till, compact, silty, gray to blue-gray, plastic, calcareous; contains plant debris (P-3800 to P-3808)	11.5	3.5
Base covered.		
Totals	54.1	16.5

Ramsey Creek Section

Roadcut in the NW cor. SW¼ SW¼ Sec. 26, T. 9 N., R. 1 W., Fayette County, Illinois, Ramsey 15-minute Quadrangle (fig. 7).

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Wisconsinan Stage		
Woodfordian Substage		
Peoria Loess		
6. Loess, noncalcareous, flaky, light brown; disturbed by roots (P-4044 to P-4047 upward)	1.6	0.5
Altonian Substage		
Roxana (?) Silt		
5. Gravel, sandy, noncalcareous, mottled reddish brown and yellow-brown (P-4038 to P-4043)	1.6	0.5
Illinoian Stage		
Hagarstown beds		
4. Gravel, noncalcareous, sandy, poorly developed bedding and cross-bedding; B-zone of Sangamon Soil (P-4019 to P-4037)	7.5	2.3
3. Gravel, noncalcareous, clayey; moderate reddish brown in gravelly portion and dusky yellow in clayey and silty portions; poorly developed bedding; B-zone of Sangamon Soil (P-4016 to P-4018)	1.0	0.3
Vandalia till		
2. Till, noncalcareous, sandy, light olive-brown in lower part grading to dusky yellow in upper part; some lenses of sand oxidized to reddish brown; CL-zone of Sangamon Soil (P-4002 to P-4015)	4.3	1.3
1. Till, calcareous, sandy, pebbly, blocky to nonblocky, oxidized, pale yellow-brown (P-4048 to P-4054; P-4000, P-4001)	11.8	3.6
Base covered.		
Totals	26.2	8.0

Ramsey West Section

Roadcut in the NW cor. SE¼ SE¼ Sec. 7, T. 8 N., R. 1 E., Fayette County, Illinois, Ramsey 15-minute Quadrangle (fig. 6).

Ramsey West Section (cont.)

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Wisconsinan Stage		
Woodfordian Substage		
Peoria Loess		
5. Loess, light brown; mostly noncalcareous, dolomitic at base (P-3304 to P-3306 upward)	1.3	0.4
Altonian Substage		
Roxana Silt		
4. Silt, gray, gleyed, noncalcareous (P-3299 to P-3303)	3.6	1.1
Illinoian Stage		
Hagarstown beds		
3. Sand, poorly sorted, poorly compacted; contains some gravel, leached; GB-zone of Sangamon Soil (P-3294 to P-3298)	3.3	1.0
Vandalia till		
2. Till, compact, sandy, tan to brown, calcareous, oxidized (P-3291 to P-3293)	2.0	0.6
1. Till, compact, sandy, gray, calcareous, unoxidized (P-3283 to P-3290)	4.6	1.4
Totals	14.8	4.5

Vandalia Bridge Section

Cutbank north of the west end of the Kaskaskia River bridge of U. S. Highway 51 in the NW¼ NE¼ SE¼ Sec. 16, T. 6 N., R. 1 E., Fayette County, Illinois, Vandalia 15-minute Quadrangle (fig. 4). (Upper few feet of section were disturbed by bridge construction and are not described.)

	Thickness (feet)	Thickness (meters)
Pleistocene Series		
Illinoian Stage		
Hagarstown beds		
5. Sand and gravel, reddish brown; slightly calcareous at base (P-3270)	0.7	0.2
Vandalia till		
4. Till, compact, sandy, pale yellow-brown, jointed and friable, calcareous (P-3258 to P-3269 upward)	19.7	6.0
Smithboro till		
3. Till, compact, silty, gray to blue-gray, plastic, calcareous (P-3252 to P-3257)	9.8	3.0
Kansan Stage		
2. Till, compact, noncalcareous; CL-zone of Yarmouth Soil (P-3250, P-3251; P-3390 to P-3395)	1.6	0.5
1. Till, compact, gray to blue-gray, calcareous (P-3245 to P-3249)	8.2	2.5
Base covered.		
Totals	40.0	12.2

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